1.1 Reliable Messages Phase 2 Thread Overview.

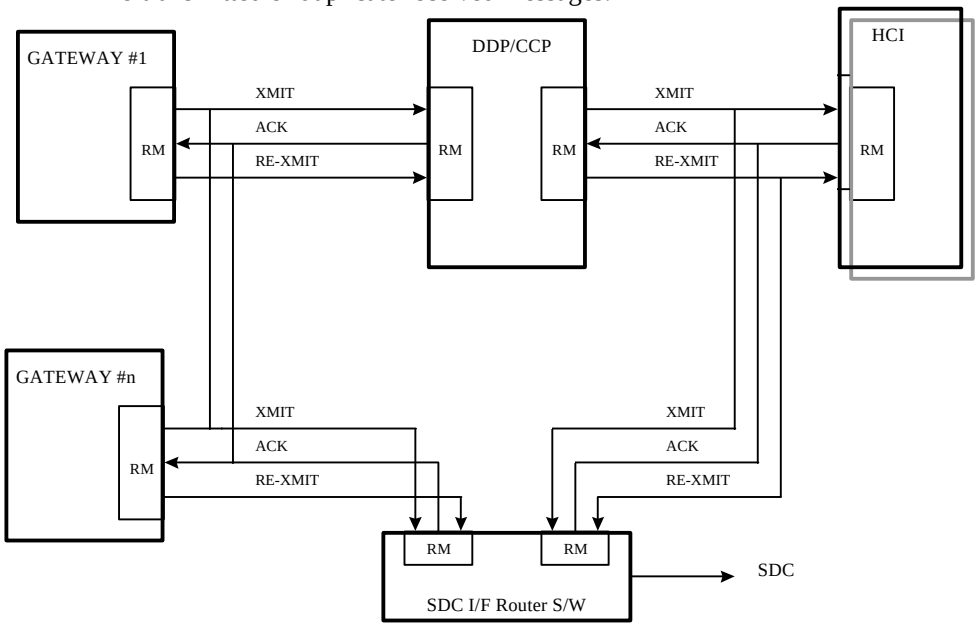
Reliable Messages provides the following major capabilities for Redstone:

- Reliable Message re-transmission and status reporting
- Provide logical communication paths in support of Application Location Transparency
- Incorporate the COTS TYMSERVE NTP Server for network time synchronization
- Investigate/analyze network fault tolerance
- Provide performance measurements and data for system modeling
- System Messages distribution recording, retrieval and display
- Assess recording of IPCs and other data types

1.2 Reliable Messages Phase 2 Concept

- The JUNO delivered Network Services APIs will be enhanced, without affecting the interface definition to applications, in support of the Reliable Messages (RM) Thread Phase 2. The design concept consists of (Refer to diagram below):

    - Code design changes for setting transmission configuration parameters (i.e. number of retries, timer settings, etc.), data error checking (CRC) and status reporting. Consideration will be made regarding safeguards to prevent real-time changes which could impact system performance.
    - Re-transmission of the current message will occur only if an acknowledgment from registered clients is not received. The acknowledgment response processing and re-transmission will be made within the RM allocated System Synchronous Rate (10ms) and System Display Rate (100ms).
    - The receiving Network Services API will contain the ability to determine whether to discard re-transmitted or duplicate received messages.



* Note: One way transmission is represented - communication is actually bi-directional

RELIABLE MESSAGES DELIVERY

- The System Messages design concept is as follows (Refer to diagram next page):

  - Message Catalog file is loaded during initialization. **For Redstone**, this file will be flat and predefined.
  - Users on the HCIs subscribe to System Messages, via the Display I/F catalog option, based on specific criteria (i.e., category, severity) .
  - A local application (i.e., Gateway #1) detects an error and calls the System Message API passing the required parameters (i.e., Message ID, Destination, Severity, etc.).

  - The System Message API performs the following major functions:

    1. Validates system message packet input parameters.
    2. Responds to applications.
    3. Queues system message for processing.

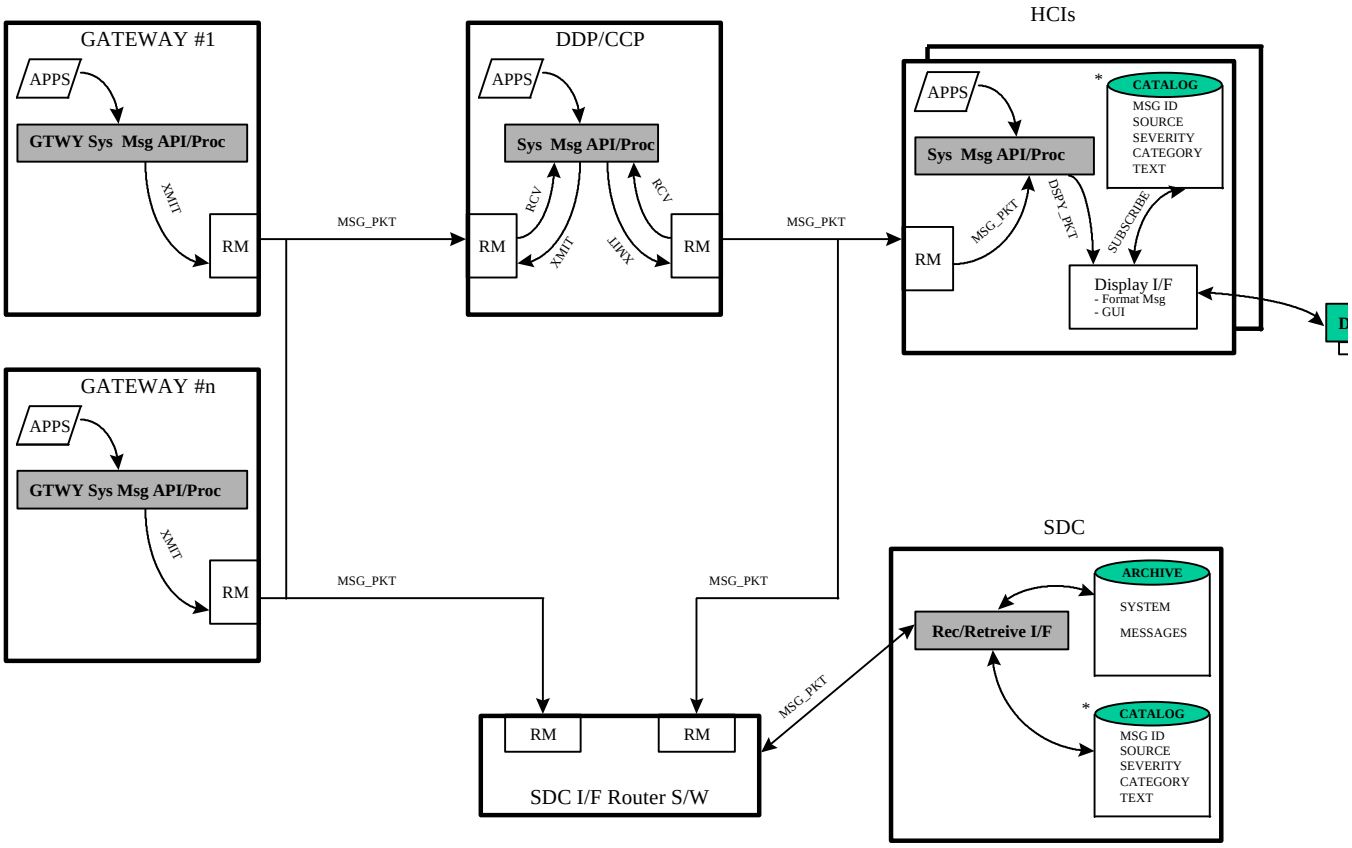
  - The System Message Process for incoming messages performs the following major functions:

    1. Establishes communication with System Message API and Display I/F GUI.
    2. Read and filter incoming System Message packets based on category and/or severity.
    3. Adds time stamp
    4. Searches the System Message Catalog for message information based on the Message ID.
    5. Formats and generates System Message Packet.
    6. Outputs the message (via RM API) for recording on SDC.
    7. Calls Display Interface for displaying the messages on platforms which contain display capability.

  - User has the capability to handle system messages, via the Display I/F (GUI), by performing the following minimum options:

    1. Subscribe to System Messages by category and or severity
    2. Acknowledge the System Message
    3. Silence alarms
    4. Clear the messages
    5. Print messages
    6. Retrieval of messages from archive using the SDC provided API
    7. Select additional message details which have been predefined in the Message Catalog

  - DDP/CCP Message Service forwards Gateway packets to the HCI.
  - System Message Packet Payloads will be sent to the SDC via the JUNO SDC I/F Router.



* Note: Message Catalog File created at Build Time and distributed during initialization.

SYSTEM MESSAGE DESIGN CONCEPT

1.3 Reliable Messages Phase 2 Thread Specification

Following is the Statement Of Work for the Redstone Reliable Message Thread, Phase 2.

Note: Changes or re-wording of the Statement Of Work is in italics.

RELIABLE MESSAGE SERVICES:

- Reliable Message (RM) Services shall take the following actions as necessary to ensure reliable message delivery:

    - Retry
      (*Duplicate - see next statement*)
    - Automatic request re-broadcast when a numbered packet is missed

      Provide re-transmission of the data messages to end stations registered for reliable message communication participation

      Re-transmission of the current data message shall complete or time-out prior to transmission of the next message received from the sending application

    - Report failed attempts and repeated retries via system messages and allow the retry count to be set per type to any number (1 to n).
      (*Duplicate - see next statement*)
    - Report repeated broadcast retries via system messages.

      At a minimum, failed attempts and repeated retries shall be reported via the *System Message Service*.

      The number of data message transmission retries shall be statically configurable per data stream type (Note: Entries will be procedurally controlled to prevent exceeding the system data transmission time limitations)

    - Abort message delivery attempt if a user specified time-out occurs.

      Message delivery attempts by the sender shall be aborted based on a configurable expiration timer set for acknowledgment responses.

    - Provide automatic sequential numbering of data packets by type.

      Provide automatic sequential numbering of data packets *based on stream or port connections*

    - Maintain a recent history of data broadcast packets by type.

      The RM shall contain the capability to receive and buffer the next application message(s) until the current message is transmitted, re-transmitted or aborted.

- Provide logical communication between CLCS Groups with local or remote routing being transparent to the caller

- Provide the Reliable Message Functions required to support both the Operational and Application configurations (e.g. DDP & HCI/DDP/CCP/GW/MM Logical Subsystems).

  Network Services shall provide logical communications such that applications on the same platform can communicate transparently as if they were remote on the network. This is in support of CLCS Application Groupings or Location Transparency onto a single platform.

- Provide performance data for system modeling.

SYSTEM MESSAGES:

- Define and implement the Packet Payload Format for System Messages
- Each System Message shall contain the following minimum contents:

  1. Source - Application Name
  2. Message Number
  3. Severity Level (e.g., Information, Warning, error)
  4. Message Group or category (e.g., RSYS, Redundancy Management, HW, GSE)
  5. Message Parameters

     Note: Multilevel groups will be required. For Example:

     a) LOX: Major Event
     b) RM: Switch..

- At a minimum, the System Message Services will:

  1. Allow the user to subscribe to one or more categories,
  2. Display the System Message Number and Text with the parameters filled in,
  3. Hide the System Message "Details" and Help until requested by the user,
  4. Provide a mechanism to group the messages by (multilevel) Message Group,
  5. Provide standard display paradigm,
  6. Provide a Standard Human Factors Interface paradigm,
  7. Provide a standard color scheme such as Severity, acknowledged, and unacknowledged messages,
  8. Provide for single and multi-line messages,
  9. Provide the capability to acknowledge messages individually and as a group.

- Each System Message will be time stamped.
- The System Message capability will provide the ability to select and deselect audible alarms.
- The System Message capability will provide the ability to turn off an audible alarm.
- Messages are displayed in outline form, graphically by Message Group.
- A summary is provided by Message Group which depicts message count by Severity and displays an indicator showing messages that have not been acknowledged for each level of severity.
- The user can clear or acknowledge messages singly, by Message Group, and Severity or in groups (i.e., by highlighting the group and then acknowledging)
- When a user registers for a new Message Group recent (TBD) messages will be displayed for the Message Group.

Groundrules:

The System Message Catalog and Help Information will be created by tools in the System Build
The System Message Text and help will not be transmitted with every message across the system.

New and JUNO Requirements not in the SOW

- Perform error checking (i.e. CRC, checksum) to reliably transfer data
- Provide application access to reliable multicast registered information and the current status of receiver acknowledgments.
- Incorporate the COTS TYMSERVE NTP Server for IRIG B network time synchronization.
- Assess recording and retrieval of IPCs and other data types.
- Investigate/analyze network fault tolerance.

1.4 Reliable Messages Phase 2 Thread Assessment Summary

Function Name	CSCI Labor	% of CSCI for Redstone	Redstone Labor
Reliable Message Service (LAN API)	24mm	50%	12mm
Logical Communication Paths	2mm	100%	2.0mm
NTP Server	4mm	60%	2.5mm
Investigate Network Fault Tol & I/F	3mm	80%	2.4mm
Assess Rec/Retr of IPCs & other types	1mm	95%	.8mm
Performance Data Collection	12mm	25%	3mm
System Message Services	18mm	70%	12.6mm
Gateway Common Services	2.5mm	100%	2.5mm
System Message Viewer	14mm	4%	5.6mm
Data Recording/Archive & Retrieval	10.5mm	60%	6.3mm

1.5 Reliable Messages Phase 2 Thread Hardware Diagram

N/A

1.6 Reliable Messages Phase 2 Thread Deliverables

Deliverable products for this capability include the following:

- An updated release of the Network Services APIs (Source, Object, etc.)
- Software Release for System Message Service (Source, Object, etc.).
- System Message Service Documentation (API Interface Definition Documents, Design Specifications, etc.)
- Network Fault Tolerance Analysis results
- Provide performance results and summary report

1.7 Reliable Messages Phase 2 Thread Schedule

1.8 Reliable Messages Phase 2 Thread Simulation Requirements

None.

1.9 Reliable Messages Phase 2 Thread System Test Requirement

Number	CSCI/CSC	Capability
1.0	SYSTEM SERVICES CSCI:	
1.1	- Network Services	
1.1.2		Reliable re-transmission of packets
1.1.3		Configuration of transmission parameters
1.1.4		Status reporting to System Message Service
1.1.5		Application location transparency
1.1.6		IRIG B Synchronization using COTS Server
1.2	- System Message Service	
1.2.1		System Message Payload packet generation
1.2.2		System Message Payload packet distribution
2.0	GATEWAY CSCI:	
2.1	- Gtwy Message Service	
2.1.1		System Message Payload packet generation
2.1.2		System Message Payload packet distribution
3.0	SYSTEM VIEWERS CSCI	
3.1	- System Message Service	
3.1.1		System Message displays
4.0	RECORDG/RETRVL CSCI	
4.1	- CLCS SDC I/F	Record/Retrieval of System Messages

1.10 Reliable Messages Phase 2 Thread Training Requirements

Training Class/Field		Number of Students		Type of Training	Approx. Period
ATM Protocol/Products		3		- Review COTS Documentation	May & June
				- Hands-on Product Usage	"
				- Professional Training Class	TBD
ATM LANalyzer		3		- Review COTS Documentation	May & June
				- Hands-on Usage	"

1.11 Reliable Messages Phase 2 Thread Facilities Requirements

- Require SDE-H configured for Redstone

1.12 Reliable Messages Phase 2 Thread Procurement

No.	PR #	ITEM DESCRIPTION	QTY	EST. DELIVERY	PURPOSE
1	N/R	LANalyzer	1	Rcv'd	Fault Tolerance Analysis
					& Performance Meas.
		SDE -H			
1	N/R	Gateway	1	Avail	Code Dev, UT, & UIT of System Messages
2	7062-6451	SGI - 02s	10	Rcv'd	
3	7055-6451	Orgin	1	On Truck	
4	7044-6455	ATM Switches	2	Rcv'd	
5	7029-6452	Edge Device	1	Rcv'd	
6	7086-6451	Printer	1	In Stock	
7	N/R	SGI - 02s	4	TBD	Not needed by this Thread
8	N/R	OPS CM Server	1	TBD	"
9	N/R	WIN Frame Server	1	TBD	"

1.13 Reliable Messages Phase 2 Thread Dependencies

SDC capability to record & retrieve System Message data 7/24/97

1.14 Reliable Messages Phase 2 Thread Action Items/Resolution

- The primary choice for data distribution on the RTCN will be IP Multicast for Redstone. Delivery of IP Multicast capability on the Gateway for Redstone by the need date of 7/15/97 is at risk. The fall back plan will be the use of IP Broadcast if the IP Multicast delivery date is not met.
- Consolidated Application (DDP, CCP, etc.) on a single platform may not be available in time to meet the Redstone delivery - network capability will be tested without these applications
- Additional Network Services API changes will be required post Redstone for System Redundancy and maturity of COTS ATM API Protocols
- Reliable Message boundaries and usage (i.e., System Message by HCIs) needs to be determined

2. CI Assessments

2.1 System Services CSCI Assessment

The following System Services CSCI functions will be provided in support of the Reliable Messages Phase 2 Thread statement of work:

Network Services API Enhancement Function Work Required

Provide code changes to the JUNO delivered Network Services APIs which include:

- Re-transmission of messages to end stations registered for reliable message communication participation
- Configuration settings for re-transmission (i.e. number of retries, timer settings, etc.)
- Error checking (CRC or checksum) and status reporting to System Message function.
- Provide automatic sequential numbering of data packets based on stream or port connections
- Provide the capability to receive and buffer the next application message(s) until the current message is transmitted, re-transmitted or aborted.

Network Services Logical Communication Paths Function Work Required

- Verify that the current Network Services APIs support this requirement.
- Testing of this capability without real DDP, CCP, etc. applications will be required.

Network Services NTP Server Function Work Required

- Install TYMSERVE NTP Server & configure NTP.

Network Services Investigate/Analyze Network Fault Tolerance Work Required

- Investigate/Analyze ATM Network fault tolerance in the SDE1.

Network Services Performance Data Collection Work Required

- Conduct ATM Switch throughput & failover time measurement using LANalyzer and provide for System Modeling

System Message Services CSC Work Required

- Custom software development of System Message API for use by applications to distribute System Messages.
- Custom software development of a System Message Server process responsible for interfacing with the System Message API and System Message GUI. In addition this process will handle initialization and validation of the System Message internal resources, formats the system messages, and creates the packet.
- Define a standardized System Message Payload Packet.
- Develop message catalog file standard and implement a flat file for Redstone.

CSCI Assessment

Function Name	CSCI Labor	% of CSCI for Redstone	Redstone Labor
Reliable Message Service (LAN API)	24mm	50%	12mm
Logical Communication Paths	2mm	100%	2mm
NTP Server	4mm	60%	2.5mm
Investigate Network Fault Tol & I/F	3mm	80%	2.4mm
Assess Rec/Retr of IPCs & other types	1mm	95%	.8mm
Performance Data Collection	12mm	25%	3mm
System Message Services	18mm	70%	12.6mm

Lines of Code

- Network Services API enhancement Lines of Code estimate is approximately 1KSLOC for Redstone.
- System Message Service Lines of Code estimate is approximately 3.8KSLOCS for Redstone.

Documentation

The following documentation will be provided:

System Messages Design Specification
System Messages API Manual

Assumptions

- The Redstone interface to SDC will remain as currently implemented for JUNO
- Recording of IPCs will not be done for Redstone
- Redundancy is not required for Redstone.

Open Issues

None.

2.2 System Viewers CSCI Assessment

The System Viewers CSCI will provide the following function in support of the Reliable Messages Phase 2 Thread System Message requirement for Redstone.

System Message Writer CSC Work Required

1. Develop a System Message Graphical User Interface(GUI) to display system messages and allow users the capability to select various options for processing system messages.
2. Coordinate System Message Displays with the users.

CSCI Assessment

Function Name	CSCI Labor	% of CSCI for Redstone	Redstone Labor
System Message Viewer	14mm	4%	5.6mm

Lines of Code

The System Message Writer Lines of Code estimate is approximately 2.2 KSLOCs for Redstone.

Documentation

System Messages User's Guide

Assumptions

- None.

2.3 Gateway Common Services CSCI Assessment

The Redstone delivery defines the initial capability provided by this CSCI.

Gateway System Message Service Work Required

The Redstone delivery defines the initial capability provided by this CSC. The capability will be added to output text system messages to a local display, a local log file, or as a global system message. This service will be implemented so that the API call will be identical to that specified by the System Services CSCI API.

CSCI Assessment

Function Name	CSCI Labor	% of CSCI for Redstone	Redstone Labor
Gateway Message Writer	2.5mm	100%	2.5mm

Lines of Code

Gateway Message Service will require approximately 500 LOC

Documentation

The FEPC to GCP API and the GCP Common API documents will be affected

Assumptions

None.

Open Issues

This technique implies that the CLCS system message packet will contain a fully formatted text string instead of a message number and parameters as in CCMS.
The Gateway CSCI will provide the following function in support of the Reliable Messages Phase 2 Thread System Message requirement for Redstone.

2.4 Data Recording/Archival & Retrieval CSCI Assessment

The Data Recording/Archival & Retrieval CSCI will provide the following function in support of the Reliable Messages Phase 2 Thread - System Message requirement for Redstone.

Recording of IPCs & other Data Types Assessment Work Required

- Define & assess the recording approach for IPCs and other data types (i.e. commands)

Data Recording/Retrieval of Message Writer Payload Packets Work Required

- Support definition of the System Message Payload Packet
- Provide initial recording and retrieval capability of System Message Payload Packets

CSCI Assessment

Function Name	CSCI Labor	% of CSCI for Redstone	Redstone Labor
Assess Recording of IPCs & Other types	.3mm	100%	.3mm
Recording of Message Writer Packets	4mm	90%	3.6mm
Retrieval	6.2mm	40%	2.4mm

Lines of Code

Estimated Software Lines of Code is 2.5KSLOCs total and 1.8KSLOCs for Redstone.

Documentation

Normal SDC development documentation as produced by the Data Recording facility.

Assumptions

This work builds on the data recording work that will be done for the Redstone "FD Data Distribution Thread".

ATM to TCP to service request will be provided by the System Services CSCI.

The Message Catalog will not be required or reside at the SDC.

The data will only be recorded in the lab.

Open Issues

Definition of the API needs to be resolved.

The CLCS packet format

The network architecture from CLCS into the SDC.

3. COTS Products Dependencies

3.1 SW Products Dependency List

- Gateway VxWorks OS upgrade

3.2 HW Products Dependency List

- ATM LANalyzer for performance measurements
- TYMSERVE NTP Server installation
- SDE 1 Redundancy ATM Hardware for investigation/analysis.